

## Knowledge Based Reasoning / Learning

(Specialization in AI Problem Solving is available as class next semester)

We have come across the following kinds of knowledge:  
 concepts\* frames and semantic networks

slots	fillers
...	...

rules\* production systems

if <a1...an> then <c1...ck>

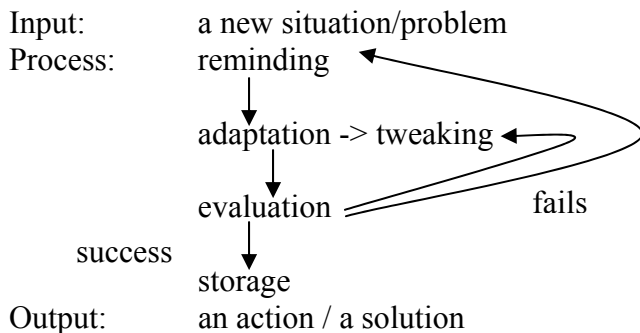
models\*

instances/cases/examples discrimination networks

\* The knowledge is learned from cases.

A lot of reasoning occurs directly on past experience. For example:  
 An architect is supposed to design a typical house in Atlanta for less than \$250,000. For this task, he picks a drawing already made for a previous house similar to the one to be designed and tweaks the old design to fit it for the customer. This way, many aspects of the old solution get transferred.

### case-based planner



Example: recipe for cooking  
 We want to make chicken and green peas. We have a recipe for chicken with broccoli.  
 ⇒ both are green vegetables  
 ⇒ tweak the original recipe and return it by replacing broccoli with green peas.

Why don't we use resolution to reason? Planning and resolution is intractable for most problems except for some very special ones.

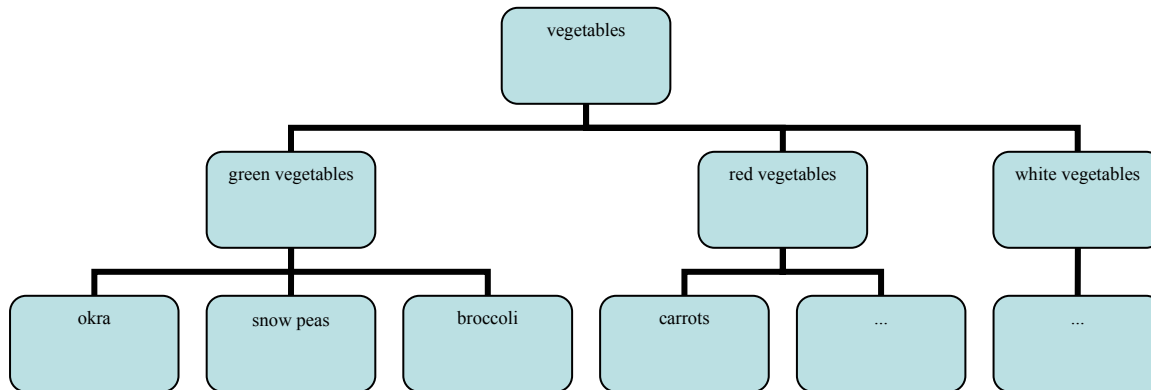
Why do humans "work?" They don't do reasoning. They record instances and they replay with closest match. (=> shift to memory)



they only play a very special and limited role in case-based reasoning – they are used only to decide on similarity.

Example for a conceptual hierarchy:

feature	new problem	old problem
Ingredient1	chicken	chicken
Ingredient2	snow peas	broccoli
style	stir-fried	deep-fried



### Adaptation (tweaking)

For adaptation, rules can be used. Again, this is no “back to rules” but only a few rules with a special role in case-based reasoning.

Example for rules:

IF <style=stir\_fried>

AND <Ingredient1=chicken>

AND <Ingredient2 in new problem and in old instance are conceptual siblings>

THEN replace<Ingredient2 in old instance by Ingredient2 in new problem>

### Learning

If you use case-based reasoning, you get (incremental) learning “for free”. Learning is therefore a functional justification for CBL/IBL.